

What we claim is:

1. A handle assembly for use in an instrument having bidirectional steering and a deflectable shaft, wherein upon being deflected in a first direction, the shaft generates a return force in an opposite second direction, and the shaft whereupon being deflected in the second direction generates a return force in the opposite first direction, the assembly comprising:

    a manually positionable control mechanism coupled to the shaft to selectively deflect the shaft in the first and second directions; and

    a counterforce mechanism operably coupled to the control mechanism and arranged to actively reduce a deflection force needed to continue to deflect the shaft in one of the first and second directions.

2. A handle assembly for use in an instrument having bidirectional steering and a deflectable shaft, wherein upon being deflected in a first direction, the shaft generates a return force in an opposite second direction, and the shaft whereupon being deflected in the second direction generates a return force in the opposite first direction, the assembly comprising:

    a manually positionable control mechanism coupled to the shaft to selectively deflect the shaft in the first and second directions, the control mechanism including a slider displaceable along a linear path for causing the deflection of the shaft in the first and second directions; and

    a counterforce mechanism operably coupled to the slider, the counterforce mechanism including a biasing element to bias the slider in a direction opposite to the return force once the slider is moved from a neutral position in which the shaft is in a straightened position, the biasing element providing a variable biasing force to the slider to counter the variable return force generated as the shaft deflects due to movement of the slider from the neutral position to one of the first and second directions.

3. The handle assembly of claim 2, wherein the control and counterforce mechanisms are disposed within a housing which has a distal end with the deflectable shaft extending outwardly therefrom and an opposing proximal end, the biasing element being connected to a proximal end of the housing.

4. The handle assembly of claim 2, wherein the control mechanism further includes a pair of control wires having distal portions respectively anchored to a distal end of the deflectable shaft corresponding to predetermined directional deflections of the instrument, the control wires extending longitudinally through the instrument and having respective proximal ends, the slider being operably coupled to the control wires such that linear displacement of the slider places one of the control wires in tension to deflect the distal end.

5. The handle assembly of claim 4, wherein the control mechanism includes a pulley to rotatably carry one of the control wires.

6. The handle assembly of claim 2, wherein the biasing force is about equal to the return force so that the forces effectively offset one another and permit a user to more easily and progressively deflect the distal end.

7. The handle assembly of claim 2, wherein the counterforce mechanism further includes:

a rotatable bell crank lever disposed within the compartment and operably coupled to the biasing element and the slider such that linear displacement of the slider causes the bell crank lever to rotate in a selected direction, the biasing force being applied to the bell crank lever to assist rotation of the bell crank lever in the selected direction in response continued linear displacement of the slider.

8. The handle assembly of claim 7, wherein the bell crank lever is pivotally connected to housing of the handle to permit rotation thereof.

9. The handle assembly of claim 7, wherein the bell crank lever is operably coupled to the slider by a traverse bar, a cam bar, and a link arm, the traverse bar being connected at a distal end to the slider and pivotally connected at a proximal end to a first end of the car bar, the cam bar being pivotally connected to the housing at a second end thereof, the link arm being pivotally connected to the cam bar at a distal end and pivotally connected to the bell crank lever at a proximal end.

10. The handle assembly of claim 9, wherein linear displacement of the slider causes the pivoting of the cam bar and the link arm resulting in rotation of the bell crank lever in the selected direction, the biasing force being applied to the slider through the traverse bar, the cam bar, and the link arm.

11. The handle assembly of claim 2, wherein the counterforce mechanism includes: a traverse bar connected to the slider at a distal end and extending longitudinally within the compartment;

first and second pivotable cross bars, the first cross bar having a first end pivotally connected to the housing and a second end pivotally connected to a proximal end of the traverse bar, the second cross bar having a first end pivotally connected to the biasing element and a second end pivotally connected to proximal end of the traverse bar, the linear displacement of the slider serving to flex the first and second cross bars and the biasing force on the second cross bar assisting in linearly displacing the slider.

12. The handle assembly of claim 11, wherein the biasing element comprises a leaf spring.